AWARD NUMBER: W81XWH-15-1-0032

TITLE: Effectiveness of a Driving Intervention on Safe Community Mobility for Returning Combat Veterans

PRINCIPAL INVESTIGATOR: **Sandra Winter, PhD, OTR/L**

CONTRACTING ORGANIZATION: **University of Florida**
Gainesville, FL 32611

REPORT DATE: May 2016

TYPE OF REPORT: **Annual**

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
May 2016	Annual	15 Apr 2015 - 14 Apr 2016

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Effectiveness of a Driving Intervention on Safe Community Mobility for Returning Combat Veterans	
	5b. GRANT NUMBER
	W81XWH-15-1-0032
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)	5d. PROJECT NUMBER
Dr. Sandra Winter, PhD	
	5e. TASK NUMBER
E-Mail: smwinter@phhp.ufl.edu	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
University of Florida 207 GRINTER HALL GAINESVILLE FL 32611	

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012	
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
This study is a follow-on to prior DOD funded work "Efficacy of a Driving Intervention Program on Safe Community Mobility for Combat Veterans". Funding for the Effectiveness (current) study was activated in October 2015 and appointed team members include CO-I's (Classen, Levy, Marsiske and Brumback) and Graduate Research Assistant (Yarney).
To date our primary focus has been Specific Aim 1: Enhance the OT-DI with development of targeted simulator drives addressing CV driving triggers and assess user satisfaction. Under Aim 1, Major Task 1 is to "Prepare Regulatory Documents and Research Protocol" which has been a focus of year one work. Following preparatory work, regulatory documents including the protocol were submitted to local VA for review in March 2016 and results with requests for revision and re-submission received in May. VA approval letters are pending which will permit submission to University of Florida IRB-01 for Full Board Review.
Additional work under Specific Aim 1 has been development of a new simulator scenario with DriveSafety. DriveSafety sent simulator content showing examples of the "boxed in" element for addition to the intervention scenarios. Dr. Winter met with DriveSafety team and reviewed the new simulator content and specifications for a new intervention drive. DriveSafety content and specifications were also reviewed with the UF team in January.

15. SUBJECT TERMS

Randomized Clinical Trial, Intervention, Driving, Rehabilitation, Simulation

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON USAMRMC
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(include area code)*
U	U	U	UU	46	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

Table of Contents

Introduction

Intervention for combat veterans' driving safety requires a multi-factorial approach to address the often co-occurring effects of TBI/ PTSD/ other blast related injuries sustained by combat veterans as well as the impact of deployment experiences on their driving. Intervention provides critical information on the combat veterans' driving fitness, impact of medical and psychological conditions on driving, and driving rehabilitation needs. Effective driving interventions have potential to increase driving safety and reduce MVC and the resulting injuries and deaths. Furthermore, promoting driving fitness may also have carryover effects supporting other key arenas of community re-integration such as family functioning, employment, participation in society, and satisfaction with life. Our pilot study data suggest efficacy of the OT-DI for combat veterans with mild TBI, PTSD, and/or orthopedic conditions but limitations include a small sample, attrition, and mostly male subjects. Further study will enable more detailed analysis of OT-DI outcomes include reduction of driving errors (measured via simulated driving evaluation), as well as real world outcomes including decreased difficulty in driving based on caregiver report and a reduction in violations, citations, and crashes based on state department of motor vehicle records. Our next step is to expand study of the OT-DI to a larger population in order to obtain further support for both its efficacy and effectiveness.

Keywords: Randomized Clinical Trial, Intervention, Driving, Rehabilitation, Simulation

Accomplishments

Working with UF Vice-president for Research we activated funding for the Effectiveness study in October 2015 and appointed team members include CO-I's (Classen, Levy, Marsiske and Brumback) and Graduate Research Assistant (Yarney). Study kick-off was held December 2015 with full team meetings in January and March to review study documentation being prepared for submission to IRB.

Our focus has been Specific Aim 1: Enhance the OT-DI with development of targeted simulator drives addressing CV driving triggers and assess user satisfaction. Under Aim 1, Major Task 1 is to "Prepare Regulatory Documents and Research Protocol" which has been a focus of year one work. Following preparatory work, regulatory documents including the protocol were submitted to local VA for review in March 2016 and results with requests for revision and re-submission received in May. VA approval letters are pending which will permit submission to University of Florida IRB-01 for Full Board Review.

Additional work under Specific Aim 1 has been development of a new simulator scenario with DriveSafety. DriveSafety sent simulator content showing examples of the "boxed in" element for addition to the intervention scenarios. Dr. Winter met with DriveSafety team and reviewed the new simulator content and specifications for a new intervention drive. The UF team also reviewed the DriveSafety content and specifications in January and implications for study design and protocol.

This study provides opportunities for joint UF-VA training of faculty, staff, and student trainees. All study staff or trainees not employed by VA and who will be engaged at VA facilities or have contact with participants train as WOC (Without compensation) and obtain study-required VA privileges. Professional development via manuscripts and presentations is described under products.

Key dates:
April 2015 – Notification of Award; October 2015 – Award funding initiated at UF and personnel appointed, initiation of submission process for UF IRB ; December 2015 – Kick-off meeting with UF team; January 2016 – Review of simulator content; March 2016 – Full submission entered in UF's MyIRB for VA review and approval; May 2016 – Response from VA with revisions requested

Impact

Impact on principal and related disciplines: Dissemination of findings is critical for rehabilitation fields such as occupational therapy and driving rehabilitation. We have continued with dissemination activities based on findings from the initial award "Efficacy of a Driving Intervention Program on Safe Community Mobility for Combat Veterans". Currently simulators are at use across both military medicine and VA health care settings, but without evidence for effectiveness of a manualized simulator intervention for driving rehabilitation. Studies on this topic are limited (fewer than five known to this author). Our impact activities include presentations and manuscripts and are listed under products heading below.

Impact on technology transfer: Content for veteran-centric driving rehabilitation being developed for these drives will become part of package for simulators sold to military and veteran health settings. Details of the driving scenarios are also described in detail in dissemination materials so concepts can be adapted for other forms of technology (i.e. other simulators or educational content).

Impact on society: Beyond direct intervention to veterans we engage in activities to raise awareness of driving safety in the larger population and the need to ensure appropriate and safe options for community mobility and integration of all citizens.

Changes/problems

As noted in first quarterly report, Dr. Winter took family medical leave in spring/summer 2015, which delayed initiation of grant activities. Further delays were experienced in VA review due to staffing issues in Research Office at North Florida/ South Georgia VA (review time extended from anticipated two weeks to three months).
Expenditures to date are less due to delayed initiation (explained above) and as two key positions (research coordinator and research therapist) remain unfilled (pending IRB approval of study). Staff training budgeted in year one is also moved until post-IRB approval.

Products

A simulator drive (tailored content for a veteran-centric intervention) is under development by DriveSafety (simulator manufacturer).

In addition we have continued dissemination activities based on initial DOD study findings.
Publications:

Classen, S., Yarney, A. K. A., Monahan, M., Winter, S. M., Platek, K., & Lutz, A. L. (2015). Rater reliability to assess driving errors in a driving simulator. *Advances in Transportation Studies, an International Journal.*

McGowan C. (2014). Combat Veterans' Perspectives on Driving Strategies to Curtail Unsafe Driving. (Honor thesis).

Szafranski, E. (2015). Understanding Combat Veterans Perspectives on Strategies to Manage Unsafe Driving and Preferences for Driving Intervention. (Honor thesis).

Sursky, S. (2015). Intermediate Term Effects of an Occupational Therapy Driving Intervention for Combat Veterans. (Honor thesis).

Miller, K. (2015) Combat Veteran Community Integration in a Driving Intervention. (Honor thesis).

Products (continued)

Presentations:
Szafranski, E., Winter, S. M., Classen, S., Yarney, A., & Levy, C. Combat veterans' strategies to manage risky driving and preferences for driving intervention. Poster presented at the American Occupational Therapy Association's 2016 Annual Conference, April 7, Chicago, Illinois.

Sursky, S., Winter, S. M., Classen, S., Yarney, A., Monahan, M., Lutz, A., Platek, K., & Levy, C. Efficacy of a simulator-based occupational therapy driving intervention for returning combat veterans. Poster presented at the American Occupational Therapy Association's 2016 Annual Conference, April 7, Chicago, Illinois.

Szafranski, E., Winter, S. M., Classen, S., Yarney, A., & Levy, C. Combat veterans' strategies to manage risky driving and preferences for driving intervention. Poster presented at the Florida Occupational Therapy Association's 2015 Fall Conference, Nov 6-7, Kissimmee, Florida.

Sursky, S., Winter, S. M., Classen, S., Yarney, A., Monahan, M., Lutz, A., Platek, K., & Levy, C. Efficacy of a simulator-based occupational therapy driving intervention for returning combat veterans. Poster presented at the Florida Occupational Therapy Association's 2015 Fall Conference, Nov 6-7, Kissimmee, Florida.

Winter, S. M., Special populations/conditions : Returning combat veterans. Presented at the 39th Association for Driving Rehabilitation Specialists (ADED) Annual Conference. Louisville, Kentucky, August 1, 2015, as part of the symposium "Driving Simulation: Sharing evidence, enhancing practice" (Classen, S. – lead author/ moderator).

Szafranski, E., Winter, S. M., Classen, S., & Levy, C. Combat veterans' strategies to manage risky driving and preferences for driving intervention. Poster presented at the 39th annual Association for Driving Rehabilitation Specialists (ADED) Annual Conference. Louisville, Kentucky, August 1, 2015

Sursky, S., Winter, S. M., Classen, S., Yarney, A., Monahan, M., Lutz, A., Platek, K., & Levy, C. Intermediate-term effects of an occupational therapy driving intervention for combat veterans. Poster presented at the 39th annual Association for Driving Rehabilitation Specialists (ADED) Annual Conference. Louisville, Kentucky, August 2, 2015.

Winter, S. M., Classen, S., Levy, C., Yarney, A., Monahan, M. Sursky, S., and Szafranski, E. Efficacy of a driving intervention for Veterans with polytrauma using a simulator. Poster presented at the VA RR&D Polytrauma conference "New Perspectives in TBI Rehabilitation". Hyattsville, Maryland, May 5-6, 2015.

Cormack, N., Classen, S., Monahan, M., Winter, S.M., Yarney, A., Lutz, A., Platek, K., & Levy, C. Efficacy of an occupational therapy driving intervention for OEF/OIF combat Veterans: A pilot study. Poster presented at the 95th American Occupational Therapy Association Annual Conference. Nashville, Tennessee, April 18, 2015.

Participants and other collaborating organizations

Veterans Affairs is a collaborator on this study with involvement of both the Center of Innovation on Disability and Rehabilitation Research, a VA Center of Innovation, and the North Florida/ South Georgia Veterans Health System. The VA provides infrastructure and support for the investigators, material resources such as the simulator, use of VA facilities for recruitment and testing, and research oversight. One Co-I, Dr. Sherrilene Classen, is at the University of Western Ontario, London, Ontario, Canada.

During this year, the following persons were active on the project:

Name: Sandra Winter
Project Role: PI
Researcher Identifier: orcid.org/0000-0002-0317-241X
Nearest person month worked: 5
Contribution to Project: Dr. Winter will have overall responsibility for the project execution. She will organize the research team and oversee all the main research functions. Thus, appoint research staff, obtain IRB approval, manage developmental activities and research activities, collaborate with the project personnel, consultant(s), and the developer of the DriveSafety 250 driving simulator. She will supervise the research coordinator, research therapist and research assistants, oversee data collection, analysis and interpretation, and develop manuscripts, research presentations and reports.
Funding Support: N/A

Name: Sherrilene Classen
Project Role: Co-I
Researcher Identifier (e.g., ORCID ID):
Nearest person month worked: 3
Contribution to Project: Dr. Classen will contribute her expertise in clinical trials, contributing to the study design and implementation, and planning and overseeing the analyses in conjunction with the PI, the biostatistician and co-investigators. Dr. Classen will contribute extensively to the development of manuscripts, the submission of presentations, dissemination of findings, and development of future proposals to extend the work.
Funding Support: N/A

Name: Charles Levy
Project Role: Co-I
Researcher Identifier (e.g., ORCID ID):
Nearest person month worked: 1
Contribution to Project: Dr. Levy's functions as a co-investigator include assisting with recruitment, guiding interaction with VA partners, and educating the team on the rehabilitation needs of the returning combat Veterans. He will participate in recruitment of participants, interpretation of the results, outcome dissemination, and translation of study findings to VA health care settings.
Funding Support: Dr. Levy is a VA physician whose salary is paid by VA, his effort is listed as 5%.

Name: Michael Marsiske
Project Role: Co-I
Researcher Identifier (e.g., ORCID ID):
Nearest person month worked: 1
Contribution to Project: Dr. Marsiske will collaborate with the team and the biostatistician on data analyses to look at the contribution of the evaluation battery to predicting real world driving performance. He will assist in development of study design, recruitment, and outcomes dissemination.
Funding Support: N/A

Name: Babette Brumback
Project Role: Co-I, Biostatistician
Researcher Identifier (e.g., ORCID ID):
Nearest person month worked: 1
Contribution to Project: Dr. Brumback will help with the design of the research studies, data management; and lead the statistical analysis and computations. She will participate in the interpretation of the results, development of manuscripts and presentations, and in outcome dissemination.
Funding Support: N/A

Name: Abraham Yarney
Project Role: Graduate Student
Researcher Identifier (e.g., ORCID ID): N/A
Nearest person month worked: 4
Contribution to Project: Primary functions are preparation of study materials for recruitment and testing, distribution of recruitment materials, and data entry. Secondary functions are data management, data audits (with PI), and analysis of data as overseen by the team and the biostatistician.
Funding Support: N/A

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period? Yes, Dr. Winter reduced her 5/8 position at the VA to 1/8. No other changes for senior/key personnel to report.

What other organizations were involved as partners?

1) Organization Name: Veteran Affairs / North Florida – South Georgia VHS
Location of Organization: Gainesville, Florida
Partner's contribution to the project:
- Financial support provided for Dr. Levy's salary and expenses for simulator van (insurance, fuel and maintenance)
- In-kind support is provided through use via revocable license of two DriveSafety simulators
- Facilities support includes use of office space at Center of Innovation on Disability and Rehabilitation Research (CINDRR) and the use of VA facilities throughout the NF/SG region for recruitment and testing
- Collaboration includes networking with CINDRR team and clinical staff of VA
- Additionally the VA provides the medical monitor for the study and VA Research Office staff review the study and oversee compliance once initiated.

2) Organization Name: University of Western Ontario
Location of Organization: London, Ontario, Canada
Partner's contribution to the project:
- Collaboration is established and responsibilities outlined through sub-contract. Dr. Classen is a Co-I / Consultant and scientific advisor to the UF team, based in part on her prior role as PI of the original DOD intervention study.

Special reporting requirements
Updated Quad Chart is attached

Appendices

Appendix A: Powerpoint from Kickoff meeting December 2015

Appendix B: Classen, S., Yarney, A. K. A., Monahan, M., Winter, S. M., Platek, K., & Lutz, A. L. (2015). Rater reliability to assess driving errors in a driving simulator. *Advances in Transportation Studies, an International Journal.*

Appendix C: Szafranski, E., Winter, S. M., Classen, S., Yarney, A., & Levy, C. Combat veterans' strategies to manage risky driving and preferences for driving intervention. Poster presented at the American Occupational Therapy Association's 2016 Annual Conference, April 7, Chicago, Illinois.

Appendix D: Sursky, S., Winter, S. M., Classen, S., Yarney, A., Monahan, M., Lutz, A., Platek, K., & Levy, C. Efficacy of a simulator-based occupational therapy driving intervention for returning combat veterans. Poster presented at the American Occupational Therapy Association's 2016 Annual Conference, April 7, Chicago, Illinois.

Effectiveness of a Driving Intervention on Safe Community Mobility for Returning Combat Veterans

Award Number – W81XWH-15-1-0032

PI: Winter, Sandra Mae   **Org:** University of Florida   **Award Amount:** $1,781,608

Study/Product Aim(s)

Specific Aim 1. Enhance the OT-DI with development of targeted simulator drives addressing CV driving triggers and assess user satisfaction (n=30)

Specific Aim 2. Evaluate group differences among the OT-DI group and the traffic safety education group measuring at baseline, post-intervention and three months post-intervention: (a) the type and number of driving errors made on a simulator, (b) CV and caregiver rating of driver difficulty, and (c) archival records, i.e. state-recorded violations, citations, and crashes. (n=180 Veterans and 150 Caregivers)

Specific Aim 3. Determine effectiveness of the OT-DI, specifically addressing the impact of the OT-DI vs. traffic safety education in reduction of total driving errors and critical driving errors such as speeding measured during simulated driving.

Specific Aim 4. Examine the impact of the OT-DI and traffic safety education on real-world driving in a sub-set of CVs (n=30) using on-road testing.

Approach: Effectiveness study of a clinical intervention using a repeated measures design.

Accomplishment: Study was reviewed by VA and is schedule for UF IRB Full Board review in August. Simulator drive development underway. Key personnel appointed and meet regularly to advance study aims.

Timeline and Cost

Activities	CY	14	15	16	17
Aim 1. Refine intervention		�▬			
Aim 2. Evaluate group differences			▬		
Aim 3. Examine tx effect simulator				▬	
Aim 4. Examine tx effect real-world driving					▬
Estimated Budget ($K)		**$518**	**$450**	**$462**	**$415**

Updated: 6/1/2016

Goals/Milestones

CY14 Goal – Refine intervention
❑ Complete user evaluation of simulator drives and integrate into intervention

CY15 Goals – Evaluate group differences
☐ Compare type and number of errors made on simulator
☐ Analyze CV and caregiver rating of driver difficulty (pre/post)

CY16 Goal – Examine treatment effect in simulator
☐ Determine effectiveness of the OT-DI, specifically addressing the impact of the OT-DI vs. traffic safety education

CY17 Goal – Examine treatment effect on real-world driving
☐ Analyze archival records, i.e. state-recorded violations, citations, and crashes

Comments/Challenges/Issues/Concerns
• We expect retention of subjects to be our biggest challenge and have a multi-faceted plan to reduce attrition across sessions

Budget Expenditure to Date : $38,497.17 as of 5/12/2016

Effectiveness of a Driving Intervention on Safe Community Mobility for Returning Combat Veterans

DOD Award # JW140063
University of Florida
Dr. Sandra Winter, PhD, OTR/L
December 3, 2015

Research Team

Investigators:

Sandra Winter, PhD, OTR/L (UF)

Sherrilene Classen, PhD, MPH, OTR/L, FAOTA (UWO)

Charles Levy, MD (VA)

Michael Marsiske, PhD (UF)

Babette Brumback, PhD (UF)

Occupational Therapists / Driver Rehabilitation Specialists:
Miriam Monahan, MS OT, CDRS, CDSI

Research Therapist TBD

Research Coordinator: TBD

Graduate Research Assistant: Abraham Yarney, MS

Overview

- Deployment and Health/ Conditions & Risks
- Background – Driving risk post-deployment
  - Past conflicts
- Community Reintegration
- Driving – Past Studies
- Rationale for Intervention
- Efficacy Study
- Proposed Intervention Aims / Methods

Deployment and Health

- Exposures
  - Blast Exposure (IED, Grenade, Shock Wave, Crash)
  - Threats from Insurgents
- Medical Conditions
  - Traumatic Brain Injury
  - Post Traumatic Stress Disorder
  - Polytrauma
- Risks
  - Suicide
  - Unintentional Injury
  - Challenges in Community Re-integration

I-MAP
Institute For Mobility, Activity, and Participation

UF College of Public Health
& Health Professions
UNIVERSITY of FLORIDA

Deployment and Driving

- Combat Veterans (CV) self-report (Lew et al. 2011; Zamorski & Kelley, 2012)
  - driving fast and unpredictably
  - sudden lane changes
  - driving in the middle of the road
  - not wearing their seatbelt
- Motor Vehicle Crash (MVC) is among the top causes of death
- Risk of crash increases with multiple deployments (Woodall et al., 2014)
- Deployment related health condition may impact driving
- Impact on community reintegration

Driving Assessment

- Person
- Vehicle (control and features)
- Environment (physical and social)

- Multi-step activity – combination of vision, cognition and motor abilities

- Evaluation
  - Demographics
  - Medical history
  - Driving history
  - Driving behaviors
- Motor (Gross ROM and MMS)
- Sensory
  - Vision
  - Sensation
  - Proprioception
- Cognitive
  - MMSE
  - Trails B
  - Useful Field of View

DriveSafety Simulator

DriveSafety 250 Simulator

Dodge Sprinter with hydraulic lift

Prior I-MAP Studies

Simulated Driving Performance
(Classen et al., 2011)

- 18 subjects with mild TBI
- OT clinical tests / evaluation of simulated driving performance
- Comparison with performance of healthy controls
- Eight driving errors

OEF/OIF Veterans' Driving Perspectives
(Hannold et al, 2014)

- Subset from Classen study
- Combat-related experiences/ events
- Impact on CVs' driving perceptions
- Triggers
- Behaviors & Strategies to manage

Prior I-MAP Studies

Efficacy of a Driving Intervention Program on Safe Community Mobility for Returning Combat Veterans (Classen then Winter - PI)

- Randomized clinical trial
- 43 Veteran drivers
- 23 Family / friends completing proxy report
- VA collaboration / State of the art simulator reaching urban and rural Veterans
- OT clinical tests / evaluation of simulated driving performance
- Comparison simulator-based intervention vs. traffic safety education

Efficacy Study Aims

Aim 1: Determine if the type and number of driving errors differ between the two groups after baseline testing to discern the role of the age, gender and "battlemind driving" phenomenon vs. medical diagnoses in driving behaviors.

Aim 2: (a) Determine if the OT-DI is efficacious (decreased type and number of driving errors; improved caregiver responses on FTDS; reduced citations or traffic violations in real world driving) for the experimental group in ST and over 3 months. **(b)** Determine if community integration and satisfaction with life increase in the experimental group.
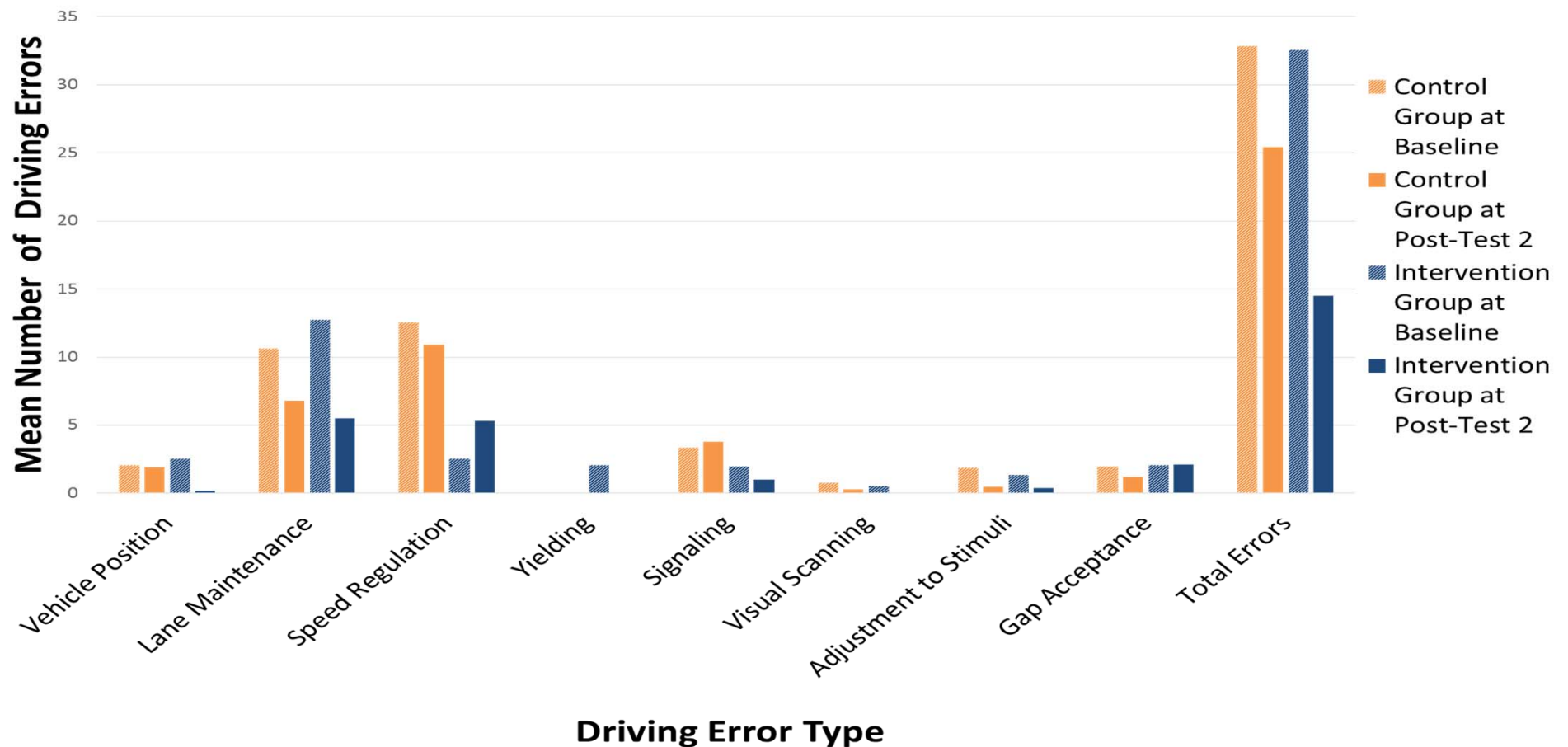
Aim 3: Explore CV perspectives on pre-war driving habits, war zone driving, "battlemind driving" phenomenon, and efforts to curtail unsafe driving behaviors, concurrently with baseline testing.

Efficacy Study Results

Variable	Control Group (n=10)	Intervention Group (n=10)
Age, _M (SD)_	36.00 (11.62)	38.60 (7.14)
Male Gender, n (%)	10 (100.00)	10 (100.00)
Diagnoses, n (%)		
Mild Traumatic Brain Injury	6 (60.00)	7 (70.00)
Orthopedic Injury	4 (40.00)	3 (30.00)
Post Traumatic Stress Disorder *co-occurring with mTBI or Ortho dx	10 (100.00)	9 (90.00)
Race, n (%)		
African-American	2 (100.00)	0
Caucasian	7 (70.00)	10 (100.00)
Other	1 (10.00)	0
Ethnicity, n (%)		
Hispanic or Latino	2 (20.00)	1 (10.00)
Not Hispanic	8 (80.00)	9 (90.00)
Education , n (%)		
High School/GED	1 (10.00)	2 (20.00)
Some College	6 (60.00)	3 (30.00)
AS Degree or higher	3 (30.00)	5 (50.00)
Marital Status, n (%)		
Married	5 (50.00)	8 (80.00)
Divorced	1 (10.00)	2 (20.00)
Single	4 (40.00)	0
Living Status, n (%)		
Alone	1 (10.00)	2 (20.00)
With Someone	9 (90.00)	8 (80.00)

* Note: Analyses using Wilcoxon Rank Sum Test and Fisher's Exact Test did not find significant between group differences

I-MAP
Institute For Mobility, Activity, and Participation

JF | **College of Public Health & Health Professions**
UNIVERSITY _of_ FLORIDA

Efficacy Study Results

Mean Driving Errors Between Groups

Efficacy Study Results

Wilcoxon Rank-Sum Test for Within and Between Group Mean Driving Error Differences

Control Group at Baseline/Post-Test 2	Intervention Group at Baseline/Post-Test 2	Control Group vs. Intervention Group at Baseline	Control Group vs. Intervention Group at Post-Test 2
W = 75.00, $p \leq .112$	W = 58.00, **$p \leq .0001$**	W = 104.50, $p \leq .493$	W = 75.00, **$p \leq .011$**

➢Two of Wilcoxon Rank-Sum analyses reached statistical significance: the intervention group's reduction of driving errors at baseline/post-test 2 and the between group differences of the control group and intervention group at post-test 2.

➢The significant reduction in driving errors for intervention group and significant between-group difference at post-test 2 suggest efficacy of the OT-DI when compared to traffic safety education.

Effectiveness Study

Move from efficacy study to effectiveness

Phase One

- Simulator enhancement - development of new simulator drives
- Training new staff to ensure fidelity of intervention

Phase Two

- Intervention testing Occupational Therapy Driving Intervention (OT-DI) vs. traffic safety education
- Examine real world driving through DMV records
- Conduct on-road driving evaluation with a sub-set of subjects

Inclusion/Exclusion

Inclusion criteria

- CV with polytrauma (TBI / PTSD, traumatic limb amputation / fractures)
- Drove prior to injury, and have / eligible for a valid driver's license
- Community dwelling
- Capacity to follow study recommendations (MMSE 24/30)

Exclusion criteria

- Conditions that may significantly limit ability to drive
  - Psychiatric
  - Physical
  - Medication-related

Repeated Measures Design
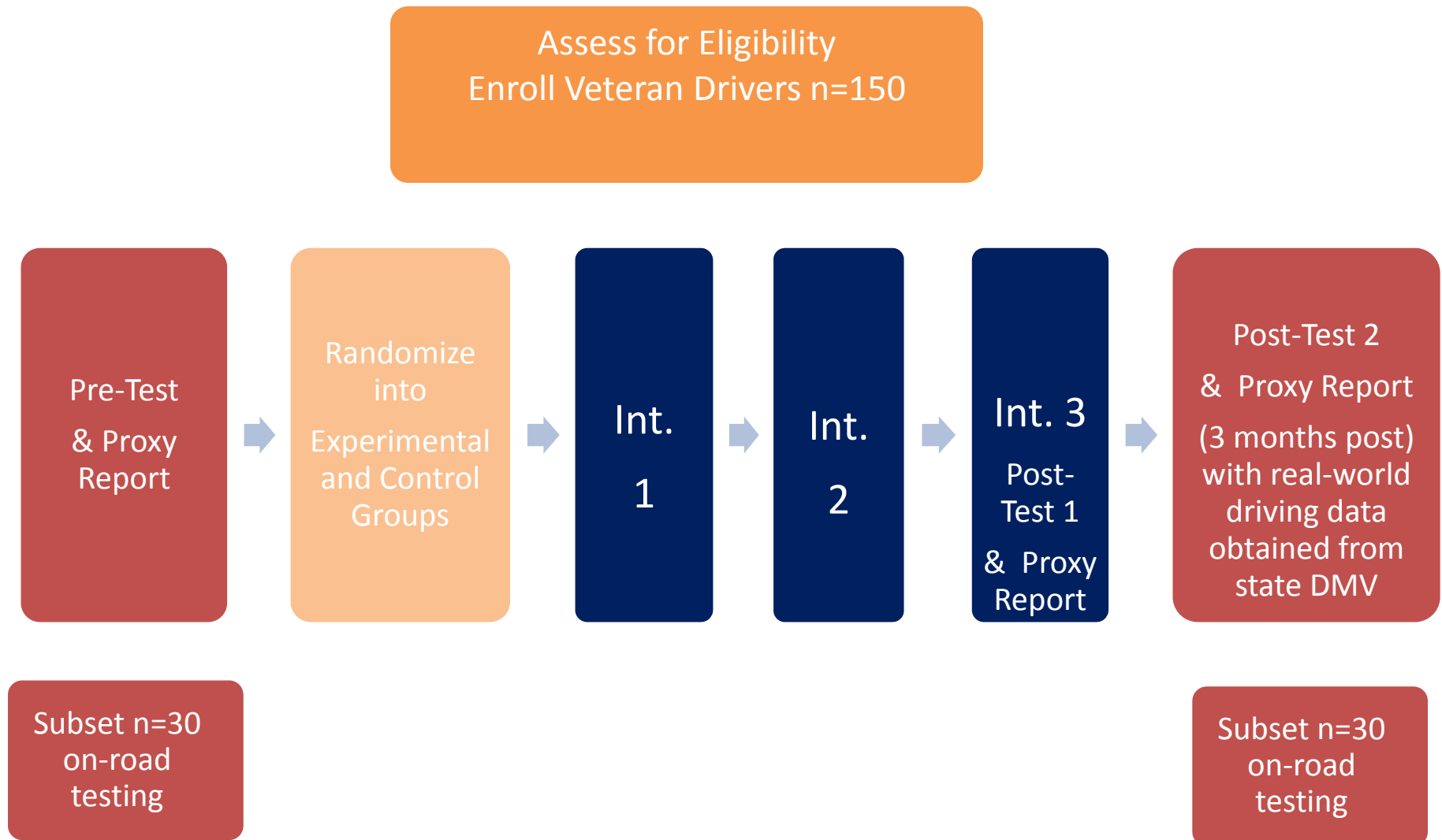
Specific Aim 1

- Enhance the OT-DI with development of targeted simulator drives addressing driving triggers identified in pilot, conduct a user evaluation.

- 1a. Develop two ten-minute drives with CV specific driving triggers. Obtain user evaluation of these drives using a testing and review process and receive feedback including visual analog scale ratings comparing the new and existing drives.

- 1b. Integrate new drives into the existing intervention and conduct pilot testing with CV (n=30). These participants will complete simulator testing of drives only and are not included in the randomized sample (N=150) due to confounding.

- Rationale – The current scenarios are not capturing key triggers of CVs' risky driving behavior.

- Significance – Simulator drives addressing newly identified triggers of CVs' risky driving behaviors will enhance the fidelity of the intervention.

I-MAP

Institute For Mobility, Activity, and Participation

UF | College of Public Health & Health Professions
UNIVERSITY of FLORIDA

Specific Aim 2

Complete the efficacy testing initiated in the pilot effort, specifically comparing the OT-DI to traffic safety education.

2a. Compare groups; assessing type and number of driving errors on a simulator and caregiver responses on FTDS at baseline, immediately post-intervention, and three months post.

2b. Determine long-range impacts of the OT-DI and traffic safety education by analyzing long-term data on real-world outcomes of driving violations, citations, and crashes using state records.

Rationale – Combat Veterans need an evidence-based intervention to address their motor vehicle crash risk

Significance – We will determine if the OT-DI is efficacious in reducing driving errors and improving driving performance as reported by a caregiver.

Specific Aim 3

Determine effectiveness of the OT-DI, specifically addressing the impact of the OT-DI vs. traffic safety education in reduction of total driving errors and critical driving errors such as speeding.

Rationale – The MVC rate for Veterans is attributed in part to these critical driving errors such as speeding.

Significance – Critical errors made by CV including speeding are understudied and there is no published data examining the effectiveness of intervention.

Specific Aim 4

Examine the impact of the OT-DI and traffic safety education on perceptions of driving difficulty measured through participant and caregiver report using the FTDS and driving performance and errors measured on-road with a sub-set of CV (N=30).

Rationale – We expect if improvement in simulated driving performance is seen, changes will also be present in real-world driving.

Significance – This SOW provides three measures of the impact of the OT-DI or traffic safety education on CVs real-world driving: change in CVs' perceived driving difficulty, change in caregiver report of the CV's driving difficulty, and change in the number and type of driving errors made on-road comparing testing at baseline and three months post-intervention.

Discussion

- Initiation of funding - November 2015

- Progress toward aims

- Limitations

- Next steps
  - Simulator enhancement
  - Team recruitment and training
  - Human subjects / IRB – VA – DOD approvals

References

Classen, S., Monahan, M., Canonizado, M., & Winter, S. (2014). Utility of an occupational therapy driving intervention for a combat veteran. *American Journal of Occupational Therapy, 68*(4), 405-411.

Classen, S., Cormack, N. L., Winter, S. M., Monahan, M., Yarney, A., Lutz, A. L., & Platek, K. (2014). Efficacy of an occupational therapy driving intervention for returning combat veterans. *OTJR : Occupation, Participation and Health, 34*(4), 177-182.

Classen, S., Yarney, A. K. A., Monahan, M., Winter, S. M., Platek, K., & Lutz, A. L. (2015). Rater reliability to assess driving errors in a driving simulator. *Advances in Transportation Studies: an International Journal, 36,* Section B, *99-108*.

I-MAP Institute For Mobility, Activity, and Participation

UF | College of Public Health & Health Professions | UNIVERSITY *of* FLORIDA

References

Lew, H. L., Kraft, M., Pogoda, T. K., Amick, M. M., Woods, P., & Cifu, D. X. (2011). Prevalence and characteristics of driving difficulties in Operation Iraqi Freedom/Operation Enduring Freedom combat returnees. *Journal of Rehabilitation Research & Development*, 48(8), 913-925.

Woodall, K. A., Jacobson, I. G., & Crum-Cianflone, N. F. (2014). Deployment experiences and motor vehicle crashes among U.S. service members. *American Journal of Preventive Medicine, 46*(4), 350-358.

Zamorski, M. A., & Kelley, A. M. (2012). Chapter 5 – Risky Driving Behavior in *Psychological Aspects of Deployment and Health Behaviours (NATO report TR-HFM-164)*. Neuilly-sur-Seine, France: Research and Technology Organisation, North Atlantic Treaty Organisation (NATO).

QUESTIONS / INPUT

Contact Information
Dr. Sandra Winter
smwinter@phhp.ufl.edu
Cell: (352) 214-3436
Office:(352) 273-7486
Institute for Mobility, Activity, and Participation
http://mobility.phhp.ufl.edu/

Rater reliability to assess driving errors in a driving simulator

S. Classen   A.K.A. Yarney   M. Monahan
S.M. Winter   K. Platek   A.L. Lutz

School of Occupational Therapy, Western University, 1201 Western Road,
London, Ontario, N6G 1H1, Canada
email: sclassen@uwo.ca, ayarney@phhp.ufl.edu

Abstract

For studies relying on rater judgments of a vulnerable population, such as returning combat veterans, high consistency between primary and secondary raters is necessary. This study examined the inter-rater reliability of a primary and two secondary raters on scoring simulated driving assessments. Seven volunteer drivers were rated in two rounds (Round 1 n=4, Round 2 n=3). Driver performance was rated for two driving scenarios, a) ten-minute city/highway scenario, and b) six-minute suburban/residential scenario to measure driving errors. Based on a set 90% cut point for intra-class correlations (ICC), we examined each rated variable for each rater pairing. After round 1, secondary raters did not achieve the 90% cut point and participated in further training. Analysis of inter-rater reliability following round 2 showed improved inter-rater reliability, i.e., 99.3% for city/highway and 98% for the suburban/residential conditions. Our results suggest that by pinpointing incongruencies in raters' assessment of driving errors, strategies including problem identification, verifying driving errors via the simulator playback function, and establishing parameters for rating each error, can resolve such inconsistencies to significantly improve their inter-rater reliability.

Keywords – simulator, raters, reliability

1. Background

The literature suggests that returning combat veterans (CV) have a 75% higher rate of being involved in motor vehicle collisions (MVC) when compared to their age cohorts [1]. Research to date acknowledges that risky driving and associated MVC among CV are most likely multi-factorial encompassing factors including medical conditions such as traumatic brain injury (TBI), post-traumatic stress disorder (PTSD), other blast related injuries, substance abuse, and driving habits retained from deployment. As of recent, many studies have used driving simulators as a means of assessing driving behaviors. Their prominence stems from it challenging drivers without creating a risk for crash involvement [2]. Additionally, assessment of driving errors is either acquired from simulator outputs, using the playback function of the simulator, or relying on judgment of the raters. The latter was used for this study as it provided opportunity for real-time driving assessment of driving errors. Because the assessment relies on the judgment of raters, there is the need to ensure raters are consistent with their error ratings. Consistency in error ratings will enhance not only rater reliability, but also the internal validity (accuracy) of the study.

Stemler [3] defines inter-rater reliability as the level of consistency between a particular set of judges on a particular instrument at a particular time. He further suggests that, if there is no evidence of consistency between raters on a particular subject, the validity of the study outcomes will be called to question, hence the need to ensure an acceptable level of agreement between raters, before the commencement of any study involving raters. Psychometrically sound simulator assessments are important whether such assessment are for clinical or research purposes. Bédard et al. [4] emphasized the importance of rater reliability when using simulated driving measures for clinical populations. They proposed that inter-rater reliability can be increased through rater training and testing protocols. Furthermore, rater reliability for driver assessment can be used at both a global rating score (pass or fail rating), or more precisely at a sub-scale level addressing rating of specific driving errors. Consistent with a standardized on-road evaluation and our prior simulator studies [5-11], our assessment of driver performance in the simulator focused on seven types of errors: gap acceptance (determining a safe time to cross in front of oncoming traffic), signaling (appropriate use of turn signals), adjustment-to stimuli (ability to properly respond to road signs, other vehicles, pedestrians or hazards), vehicle positioning (spacing between vehicles), speed regulation (maintaining speed limits), lane maintenance (lateral positioning of the vehicle), and visual scanning (checking mirrors before lane changes and intersecting roads before crossing) [12]. Additionally we have included subcategories for lane maintenance (encroach and wide) and for speeding (under and over), for a total of 11 driving errors. Rating performance deficits by error type, as explained above, is critical for making a reliable assessment among drivers.

1.1. Rationale and significance

Prior to commencing any study, or as in this case, a study testing the efficacy of an Occupational Therapy Driving Intervention (OT-DI) for returning CV, one must establish high inter-rater reliability among study raters assessing simulated driving errors. Therefore, the purpose of this study was to identify sources of rater variability among raters before commencement of the primary study, and to examine if appropriate training can minimize discrepancies while increasing reliability coefficients among the raters. The significance of this procedure is to ensure that consistent ratings occur across raters as they are evaluating driving errors. In the absence of determining and refining inter-rater reliability, studies will fall short of obtaining strong rater agreement and thus compromise internal validity as well. As such, this study will contribute to refining the protocol of a driving simulator study in showing the necessity for analyzing rater assessments, identifying and addressing rater incongruencies, allowing for rater retraining, and retesting the ratings to increase correlation coefficients and ensuring high-inter rater reliability.

1.2. Study question

We asked what are the levels of agreement among the three raters when assessing drivers for each driving error and under each driving condition (city/ highway and suburban/residential); and secondarily, if acceptable levels (>90%) were not reached, could training increase the reliability (to the acceptable level) among the three raters?

1.3. Participants

The three raters were all research team members, whose consistency in rating drivers, was key to the primary study.

The three raters were all occupational therapists (OT) with professional training in driving rehabilitation. The primary rater (MM) was an occupational therapist and a Certified Driver Rehabilitation Specialist (OT-CDRS) with fifteen years of experience, and the two secondary raters (AL and KP) were Driver Rehabilitation Specialists (OT-DRSs) with less than one year of experience each.

2. Description of DriveSafety CDS-250 driving simulator

We used the DriveSafety CDS-250 driving simulator [13], a high-fidelity simulator with a console configuration of a Ford Focus sedan (2008 model). This simulator is equipped with standard driving controls, computerized information systems, and an automotive control environment. The "live" controls of the CDS-250 simulator are its steering wheel with active force feedback, automatic transmission, turn signals, gas and brake pedals. The readouts of the CDS-250 driving simulator include a speedometer and a high-fidelity sound system which creates digital audio simulation of driving sounds. It presents a 65^0 field-of-view with rendered scenes representing 110^0 horizontal view on tri-screen monitors, showing side and rear view mirrors. The CDS-250 driving simulator runs on DriveSafety's Vection™ simulation software, in which traffic interacts realistically with other vehicles, based on human behavior/decision models and real-time physics-based vehicle dynamics calculations. The simulator is programmed with a "record" feature that allows simulated driving performance to be captured, with a "playback" feature enabling subsequent review by raters.

2.1. Suburban and residential driving scenario

This drive starts in a residential neighborhood on a narrow two-lane road, with no markings, and a 25-mph speed limit. This road section has a visually cluttered environment with traffic, parked cars, trash cans at the curb, pedestrians crossing the road way, and road kill.

The driver encounters three four-way stop intersections, one right turn and two left turns maneuvers. The drive transitions to a two-lane rural road, at 45 mph, and then to a commercial four-lane road with busy intersections at 35-mph. The drive ends at a strip mall.

Fig. 1 - Driving simulator (DriveSafety250)

Fig. 2 - Residential view of suburban and residential driving scenario

Fig. 3 - Overhead view of suburban and residential driving scenario

The drive has three scripted events: (1, 2) a car and truck pull out in front of the driver, and (3) a lead vehicle brakes suddenly because of a cyclist. The drive also includes six additional triggers that were specifically identified for CV driving as elements that may either evoke emotional reactions, such as hypervigilance or anxiety, potentially leading to driving errors. They include: (1) a car pulls out from the right and swerves, (2) a trash can located close to the street, (3) a backfire sound comes from a motorcycle, (4) a pedestrian enters the crosswalk of the street the driver is turning on to, (5) a deer carcass lies on the road shoulder, and (6) an unprotected left turn unfolds at an intersection with traffic in opposing lanes.

2.2. City and highway drive scenario

This drive starts in an urban area presenting multi-lane (four or more) and narrow city streets as well as moderate flow of traffic and moderate pedestrian activity. The drive proceeds to freeway driving, with some added features such as road-side debris. The drive terminates in a commercial area. The drive has two scripted events, which include (1) a car pulls out suddenly in front of the driver, (2) a man steps out from parked car (Figure 4). The drive also includes seven additional triggers: (1) trash close to the drive path, (2) barriers at the beginning of the expressway, (3) a parked car with three men and a cow on the road-side, (4) the sound of a helicopter above the car, (5) two cars on the road-side with a man and a woman standing by the cars, (6) a dead dog on the left curve of the road, and (7) bridge trash on the road-side.

Fig. 4 - Driver view of the city and highway driving scenario

3. Procedure

This study was approved by the University of Florida's Institutional Review Board, the North Florida / South Georgia Veterans Affairs Research Committee, and the Department of Defense Human Research Protection Office (HRPO).

3.1. Drivers

All volunteer drivers were introduced to the simulator through a standard acclimatization process of three short driving segments. This allowed for physiological adjustment to the simulator and also encompassed training on how to ensure appropriate lane keeping, speed maintenance and stopping. Ratings were conducted over two rounds and rater reliability was assessed after each round to determine the need for further training or refinement of the simulator protocol. In round one, four drivers were rated; in round two three drivers were rated.

3.2. Raters and ratings

All raters were trained prior to actually evaluating the volunteer drivers. This training included the raters first understanding the different driving errors, and second identifying the errors via pre-recorded simulator examples in the presence and under guidance of a senior rater. No actual data were collected on the pre-training process, but based on the approval of the senior rater who indicated that all raters had knowledge and skills to identify the driving errors, the raters proceeded with rating the seven volunteer drivers. The raters made observations and ratings for each driver, and for both driving scenarios, as detailed above. During the two drives, the primary rater as well as the secondary raters concurrently evaluated the performance of the volunteer driver based on the seven main (11 in total driving errors which included sub categories for lane maintenance and speeding) driving errors previously described. We used a standardized driving error scoring sheet [12], adapted for the simulator, to rate the driving errors (copy can be obtained from the first author). The raters rated each of the driving errors by type and number. We also used the simulator playback feature to further assess driving errors at each drive. For example, the DRSs rated the participants while driving to capture driving errors, and afterward used the playback function of the simulator to verify if all the errors were actually correctly identified. If an error was missed, the original rating was amended to reflect all of the errors occurring. To identify problems or challenges in the rating process, the senior rater (OT-CDRS) led the discussions with the two secondary raters (DRSs). For example: if a discrepancy was noted between or among the raters, the problem was identified; the playback function of the simulator watched and the discrepancies discussed; and finally, to ensure consistency in rating, parameters were established.

Although the simulator has the capability to provide kinematics/output data, we did not utilize this function, for three reasons. First, the simulator does not account for driver behavior due to an obstacle in the road. For example, if a driver needs to cross the centerline as a result of a parked car, the simulator will calculate this maneuver as a driving error, while it is totally realistic to avoid obstacles by crossing the center line. Second, if a driver slows down or speeds up, the simulator will indicate incongruency in speeding, while in reality, the driver might have avoided a hazard, such as having to slow down or speed up to not hit a vehicle that has not allowed a large enough gap. Third, DRSs must assess driving performance in the real world without instrumentation. Because this study used DRSs, we wanted to test and enhance their ability to assess driving errors in the absence of using simulator output data.

After collecting the data on the standardized form, we keyed the data into an Excel spreadsheet. All the error data were then keyed into SPSS. Specifically, we used IBM SPSS statistics version 22 [14] to conduct the intra-class correlation coefficient (ICC) analyses.

A low average ICC for a particular drive, for instance city/highway, suggests potential inconsistent ratings amongst the raters (low rater agreement). Therefore, to identify the source of inconsistency, we identified the ICCs of all the tabulated variables that did not satisfy the a-priority determined 90% criterion. To further identify rater disagreement, we conducted a pairwise rater ICC comparison for each variable (driving error). For example, with three raters, i.e., R1, R2, R3 involved in the process, we paired R1 and R2, R1 and R3, and R2 and R3. Based on the ICCs for each pair, we identified driving errors with low rater agreement.

If the raters did not meet the 90% criterion, the areas of weak agreement were identified and corrected using the problem-solving approach described previously. Upon satisfactory problem solving (as judged by the primary rater), the raters proceeded with rating the second group of drivers. The ICC results from the second group of drivers were juxtaposed to the ICC results of the first group of drivers to indicate any improvement in rater agreement. Again, we expected an average ICC per drive to meet the >90% criterion, indicating high inter-rater reliability.

4. Data analysis and management

A trained research assistant (AY) tallied rater evaluation sheets to attain the total number of driving errors, observed by type, for the suburban/residential drives and the city/highway drives. The number of each driving error was keyed into IBM SPSS Statistics version 22 [14]. We used the *Reliability Scale Tool* in IBM SPSS Statistics version 22 [14] to estimate and tabulate the intra-class correlation coefficient (ICC), as shown in Table 1.

5. Analysis model

According to McGraw and Wong [15] two main groups of models are used in inter-rater reliability analysis, one-way and two-way random effect ANOVA models. The choice of any of the above models depends on the anticipated variance within the raters or the drivers. In our experimental setup we anticipated variance between the drivers and raters, hence we decided to use the two-way ANOVA model.

Additionally, McGraw and Wong posited that if the raters involved in the study are fixed and not random, as was the case in this study, then the model of choice is the random mixed model. Therefore, for this study, we used a random mixed model and assumed a 95% confidence interval for the analysis.

6. Results

The results of the study have been grouped into two parts as first and second round rating results. The first round rating refers to the results of the first group of volunteer driver, whereas the second round ratings refer to the second group of volunteer drivers.

6.1. First round of ratings (n = 4 drivers and 12 pairings)

The results of the first analysis showed rating discrepancy among raters for the following driving errors: For the suburban/residential conditions - lane maintenance, wide lane maintenance, over speeding and signaling.

For the city/highway condition, we found rater discrepancy for over speeding and signaling. Rating discrepancies pertained to secondary raters who over or under estimated driving errors when compared to the primary rater's rating scores.

Interestingly, the discrepancies among these very concrete errors, begged the question of why they existed. Upon using the problem solving approach the raters found that not all roads had center lane lines (especially under suburban/residential conditions), which of course complicated the consistency in rating without such a distinctive parameter. Additionally, sometimes a vehicle was parked in the driver's pathway and he/ she had to pass by the parked vehicle, often times going over the center lane line in doing so. While some raters marked this as an error, it is clear that the driver had to incur this maneuver to avoid crashing into the parked vehicle. For "over speeding", the problem solving approach among the raters indicated that the driver had to increase the speed rapidly, to avoid hitting a car with an unsafe gap. Such a maneuver was therefore, given the context, necessary to avoid an adverse event. Likewise, signaling was rated inconsistently. The raters had to not only define if a turn signal was turned on or not, but also decided when and where a turn signal needed to be turned on/off. In the absence of clear parameters, as described above, inconsistencies were evident in the raters' ratings.

6.2. Second round of ratings (n = 3 drivers and 9 pairings)

Compared to the results of the first analysis, there was improvement in the percentage agreement among the three raters for all the driving errors where incongruences existed during the first analysis. Improvements ranged from 10% to 50%. The results suggested that a preliminary study of rater reliability, coupled with training to resolve inconsistencies in ratings, can lead to improved outcomes in rater agreement. Therefore rater training, testing, and retraining in simulator studies must be a necessary part of establishing internal validity of a study and must precede data collection.

Tab. 1 - Inter-rater reliability test results for volunteer drivers

	First analysis		Second analysis	
Date	3/12/2013	3/12/2013	4/22/2013	4/22/2013
Number of drivers, N	n= 4	n= 4	n= 3	n= 3
Driving errors	% agreement for city/ highway	% agreement for suburban/ residential	% agreement for city/ highway	% agreement for suburban/ residential
Visual scanning	100	100	100	100
Lane Maintenance	92.3	50	99.3	100
Encroach lane maintenance	98.4	100	100	100
Wide lane maintenance	100	80	100	100
Under speeding	88.7	92.8	99.1	97.9
Over speeding	71.2	75	100	85.7
Vehicle position	88.9	97.7	96.8	100
Adjustment to Stimuli	94.1	100	100	93.8
Signaling	78.9	80	97.4	100
Gap acceptance	100	-	100	100
Yielding	100	100	100	100
Total Average	92	87.6	99.3	98

Table 1 indicates the results of the first analysis (city/highway scenario), for the driving errors and shows that the results for four of these errors (under speeding, over speeding, vehicle positioning, and signaling) fell short of the 90% ICC criterion. However, the average ICC for all 11 driving errors was 92%. Therefore, to improve the rating of driving errors that fell short of the 90% ICC criterion, we used the simulator's playback function for raters to re-evaluate those driving errors. As part of the retraining conducted by the primary rater (OT-CDRS), raters re-evaluated the driving scenarios with the playback function of the simulator three times while discussing rating criteria, before raters proceeded with the second round of ratings. The results of the second analysis showed a remarkable improvement in an average ICC of 99.3%. Similarly, for the suburban/ residential scenarios, ratings for four driving errors (lane maintenance, wide lane maintenance errors, over speeding and signaling) fell short of the 90% criterion. After training, the results of the second round of ratings also showed an improvement in the overall ICC from 87.6% to 98%. This process clearly shows that a targeted training approach (described in "Raters and Ratings") is vital to achieving a global improvement in the overall ICC and agreement between rater pairs.

7. Discussion

The purpose of this study was to ascertain the inter-rater reliability among three raters for a driving intervention study. We used seven volunteer drivers who drove a driving simulator in city/highway and suburban/residential environments. We studied the ratings of three raters, over two rounds, on volunteer drivers. We also assessed the impact of training among the raters to improve congruence in scoring. Driving simulators have gained acceptance as being safe and cost-effective tools for assessing driving performance of road users [4, 16, 17]. However the validity of raters in assessing the drivers is important, and somewhat under documented in the literature. Although some studies relied on the replay function of simulators [4, 16, 17], other studies [4, 18, 19] used the judgment of raters to provide immediate assessment of participants.

The results of this study suggest that by identifying the rater(s) and issues of incongruence, further training may be beneficial to resolve the inconsistencies in rating and rater. As such, our findings corroborate suggestions made by Bédard et al. [4] related to proving reproducibility of simulator findings between raters. This study also suggests that after training of the raters, the reliability can further improve to an acceptable level. In fact, the raters benefited from the process embedded in this study in that they had to: (1) adopt a problem solving approach; (2) learn that even though they were trained, they could still incorrectly and inconsistently identify driving errors; (3) verify their ratings with another method, in this case, the simulator playback function; and (4) define parameters to accurately rate driving errors and in so doing avoid introducing systematic error. Increasing the sample size of the volunteer drivers, as well as the numbers of raters, may impact the estimates. Therefore our findings are limited in generalizability. However, the results of our study underscore the need for a concerted effort in ensuring high inter-rater reliability prior to data collection. Overall this research study showed that raters, with differing levels of experience, who are rating the driving performance of volunteer drivers in a driving simulator, can obtain strong rater agreement. As such, this finding in particular, has implications for planning the protocol of a driving simulator study, in this case for returning combat veterans. We show the necessity for rater training, analyzing rater assessment, identifying and addressing rater incongruences, using the simulator playback function for verifying driving errors, retraining of raters, and retesting of the ratings to increase correlation coefficients and ensuring high-inter rater reliability.

Acknowledgements

References

1. National Highway Traffic Safety Administration, Air National Guard Executive Safety Summit. (2010). Remarks prepared for Ronald Medford, deputy administrator. [Online] NHTSA. Available at: <http://www.nhtsa.gov/staticfiles/administration/pdf/presentations_speeches/Medford-ANG_06222010.pdf> [Assessed November 21st 2014].
2. Rizzo, M., Jermeland, J. & Severson, J. (2002). Instrumented vehicles and driving simulators. Gerontechnology, 1, pp. 291-296.
3. Stemler, S. E. (2004). A comparison of consensus, consistency, and measurement approaches to estimating inter-rater reliability. Practical Assessment, Research & Evaluation, 9, pp. 66-78.
4. Bédard, M., Parkkari, M., Weaver, B., Riendeau, J. & Dahlquist, M. 2010. Assessment of driving performance using a simulator protocol: Validity and reproducibility. American Journal of Occupational Therapy, 64, pp. 336-340.
5. Classen, S., Monahan, M., Canonizado, M. & Winter, S. (2014). Utility of an occupational therapy driving intervention for a combat veteran. American Journal of Occupational Therapy, 68, pp. 405-411.
6. Classen, S. & Brooks, J. (2014). Driving simulators for occupational therapy screening, assessment, and intervention. Occupational Therapy In Health Care, 28, pp. 154-162.
7. Classen, S., Cormack, N. L., Winter, S. M., Monahan, M., Yarney, K. A., Lutz, A. L. & Platek, K. (2013). Efficacy of an occupational therapy driving intervention for returning combat veterans. OTJR: Occupation, Participation, and Health, 34, pp. 177-182.
8. Classen, S., Shechtman, O., Joo, Y. T., Awadzi, K. D. & Lanford, D. N. (2011). Traffic violations vs. driving errors: implications for older female drivers. In: Transportation Research board (ed.) 4th International Conference on Women's Issues in Transportation. Irvine, California: Transportation Research Board.
9. Classen, S., Shechtman, O., Awadzi, K. D., Joo, Y. & Lanford, D. N. (2010). Traffic violations versus driving errors of older adults: Informing clinical practice. American Journal of Occupational Therapy, 64, pp. 233-241.
10. Shechtman, O., Awadzi, K. D., Classen, S., Lanford, D. & Joo, Y. (2010). Validity and critical driving errors of on-road assessment for older drivers. American Journal of Occupational Therapy, 64, pp. 242-251.
11. Shechtman, O., Classen, S., Stephens, B., Davis, E., Awadzi, K. D. & Mann, W. (2008). The impact of roadway intersection design on simulated driving performance of younger and older adults during recovery from a turn. Advances in Transportation Studies, an International Journal, Special Issue, pp. 7-20.
12. Justiss, M. (2006). Development of a Behind-the-wheel driving performance assessment for older adults. Dissertation, University of Florida.
13. DriveSafety (2014). CDS-250. [online] Available at: <http://www.drivesafety.com/products/3/17/CDS-250> [Assessed November 2014].
14. IBM Corp. (2013). IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.
15. McGraw, K. O. & Wong, S. 1996. Forming inferences about some intraclass correlation coefficients. Psychological Methods, 1, pp. 30-46.

16. Godley, S. T., Triggs, T. J. & Fildes, B. N. (2002). Driving simulator validation for speed research. Accident Analysis & Prevention, 34, pp. 589-600.
17. Lee, H. C., Cameron, D. & Lee, A. H. (2003). Assessing the driving performance of older adult drivers: on-road versus simulated driving. Accident Analysis & Prevention, 35, pp. 797-803.
18. Classen, S., Shechtman, O., Stephens, B., Davis, E., Justiss, M., Bendixen, R., Belchior, P., Sandhu, M., Posse, C., McCarthy, D. & Mann, W. (2007). The impact of roadway intersection design on driving performance of young and senior adults. Traffic Injury Prevention, 8, pp. 69-77.
19. Shechtman, O., Classen, S., Awadzi, K. D. & Mann, W. 2009. Comparison of driving errors between on-the-road and simulated driving assessment: A validation study. Traffic Injury Prevention, 10, pp. 379-385.

Combat Veterans' Strategies to Manage Risky Driving and Preferences for Driving Intervention

Emily Szafranski, BHS Honors Student [1]; Sandra Winter, PhD, OTR/L [1, 3]; Sherrilene Classen, PhD, MPH, OT Reg. (Ont.), FAOTA [1, 2]; Abraham Yarney, MS [1]; & Charles Levy, MD [1, 3, 4]

[1] Department of Occupational Therapy, University of Florida, [2] School of Occupational Therapy, University of Western Ontario, [3] VA Center of Innovation on Disability and Rehabilitation Research, [4] Malcom Randall VA Medical Center, Physical Medicine and Rehabilitation Service

BACKGROUND

➢ Combat Veterans (CV) face an increased risk of motor vehicle crashes leading to injury or death; and have reported driving difficulty that impacts their community reintegration (Plach & Sells, 2013).

➢ The most common OEF/OIF combat related injuries, mild traumatic brain injury (mTBI), orthopedic injuries, and posttraumatic stress disorder (PTSD), may contribute to unsafe driving.

➢ Life-saving techniques used in combat such as speeding, straddling the midline to avoid roadside bombs, and making unpredictable lane changes are often difficult to unlearn, and may result in dangerous driving behaviors in a noncombat situation (Lew et al., 2011; Possis et al., 2014).

➢ Hannold, Classen, Winter, Lanford, and Levy (2013), identified that a CV was influenced by deployment experiences, which affected their perceptions and behaviors.

PURPOSE

The purpose of this study was to gain insight on CV's perspectives of deployment training, driving experiences pre and post deployment, strategies to manage driving behaviors, and preferences for a driving intervention.

METHODS

➢ Participants enrolled in the efficacy trial, were contacted by phone and invited to participate in the focus group.

➢ Focus group meeting included three participants and lasted approximately 75 minutes.

➢ The moderator asked a series of open-ended questions to generate discussion among participants.

➢ The principal investigator and a trained research assistant transcribed the digital audio recordings verbatim and verified the transcript against field notes, before coding.

➢ Themes and codes from this analysis were compared to an earlier qualitative analysis within the larger study examining CV's perspectives on driving strategies (McGowan, 2014).

RESULTS

Figure 1. Primary Themes and Supporting Quotes

Deployment Training — "A lot of high speed driving, under controlled circumstances on a closed loop track. You'd bump into each other, you'd do pit maneuvers…"

Driving experiences while deployed — "It makes you a little bit more nervous, but you trying to get there as fast as you can and get back without encountering anything. But you never know."

Driving experiences post deployment — "…I get really paranoid about it, it's like this person wants to be very close to me for some reason."

Strategies to manage driving behaviors — "It brings it back to my mind, I'm not deployed I'm here."

Preferences for intervention — "My suggestion would be just basic supervised driving with feedback. It would be far more beneficial if it was out on the road driving a set route."

Figure 2. Triggers impacting CVs' driving

Traffic lights — "… sometimes at the stop lights I just wanna go."

Slow drivers — "…you dummy, you know you're in the way. You're in the fast lane and you're just going 40 …the speed limit is 70, and you need to move over."

Feeling of being followed or watched — "…cause I'm using cruise control and they pass me, going back and forth, and that really starts to piss me off cause it's almost like they're watching me, trying to provoke me…"

RESULTS

Figure 2. Responses impacting CVs' driving

Speeding — "I don't know what the speed limit is, don't care, just realized I was going too fast."

Aggressive driving — "Cause I really wanna take my big truck and just run right over them."

Escape mode — "…because there's no reason for it. But definitely get in escape mode when something like [discourteous drivers] that comes up."
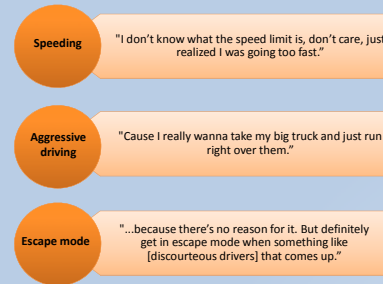
Figure 3. Reported strategies used to manage unsafe driving

Self-talk — "Now I'm slowly getting to the point of, 'okay, I gotta slow down.' Gotta get myself back together, because I'm not in a hurry to get to the place I'm tryin to get to."

Vehicle Technology — "…I put it on cruise control as long as the traffic's not heavy."

Pull off the road — "…but you just gotta talk yourself out of it [being angry], calm down a little bit, pull to the side of the road for a few minutes."

Visual scanning — "…making a sweep across the instrument panel…looking at both your mirrors."

DISCUSSION

Data indicate that:

➢ Participants' learned driving behaviors in combat were reinforced post deployment.

➢ Despite their ability to recognize unsafe driving behaviors, CVs have difficultly responding appropriately when exposed to triggers.

➢ The lack of driver re-education training post deployment may impact their ability to curtail unsafe driving behaviors.

➢ Findings were consistent with related research that demonstrated factors such as anxious driving, triggers, and combat-related experiences, which influenced post deployment driving (Hannold et al., 2013; Hwang et al., 2014).

➢ This focus group study contributes to the body of literature describing driving performance and driving safety of returning CVs from Iraq and Afghanistan.

➢ Clinicians working with this population may benefit from study findings in order to understand CVs perspectives on driving, challenges experienced, strategies used to curtail unsafe driving, and preferences for intervention.

REFERENCES

Hannold, E.M., Classen S., Winter S., Lanford, D.N., Levy, C.E. (2013). Exploratory pilot study of driving perceptions among OIF/OEF Veterans with mTBI and PTSD. Journal of Rehabilitation Research & Development, 50(10):1315–1330.

Lew, H. L., Kraft, M., Pogoda, M. T., Amick. M. M., Woods, P., Cifu. X. D. (2011). Prevalence and characteristics of driving difficulties in Operation Iraqi Freedom/OperationEnduring Freedom combat returnees. Journal of Rehabilitation Research & Development, 48(8), 913-926

McGowan, C. (2014). Combat Veterans' Perspectives on Driving Strategies to Curtail Unsafe Driving (Unpublished thesis). University of Florida.

Plach, H. L., & Sells, C. H. (2013). Occupational performance needs of young veterans. American Journal of Occupational Therapy, 67(1), 73-81.

Possis, E., Bui, T., Gavian, M., Leskela, J., Linardatos, E., Loughlin, J., Strom, T. (2014). Driving difficulties among military veterans: Clinical needs and current intervention status. Military Medicine, 179(6). 633-639.

I-MAP
Institute For Mobility, Activity, and Participation

UF College of Public Health & Health Professions
UNIVERSITY of FLORIDA

Intermediate Term Effects of an Occupational Therapy Driving Intervention for Combat Veterans

Stephanie Sursky, BHS Honors Student [1]; Sandra Winter, PhD, OTR/L [1,3]; Sherrilene Classen, PhD, MPH, OT Reg. (Ont.), FAOTA [1,2]; Abraham Yarney, MS [1]; Miriam Monahan, MS, OTR/L, CDRS [1,2]; Amanda Lutz, MOT, DRS, OTR/L [1]; Kyle Platek, DRS, OTR/L [1]; & Charles Levy, MD [1,3,4]

[1] Department of Occupational Therapy, University of Florida, [2] School of Occupational Therapy, University of Western Ontario, [3] VA Center of Innovation on Disability and Rehabilitation Research, [4] Malcom Randall VA Medical Center, Physical Medicine and Rehabilitation Service

BACKGROUND

- Combat veterans (CVs) returning from Operation Enduring Freedom (OEF) or Operation Iraqi Freedom (OIF) have reported experiencing challenges with community reintegration and activities of daily living following deployment, including driving [1].
- Conditions such as mild traumatic brain injury (mTBI), posttraumatic stress disorder (PTSD), polytrauma, deployment exposures, and the presence of risky driving behaviors may contribute to impaired fitness-to-drive in CVs [2].
- I-MAP studies have used driving simulators to address the efficacy of an Occupational Therapy Driving Intervention (OT-DI), including a pilot study where CVs with clinical diagnoses made more speeding and adjustment to stimuli driving errors than healthy controls [3] and a study where CVs made fewer total driving errors at post-test 1 (after receiving the OT-DI) than at baseline testing [4].

PURPOSE

- Based on prior studies [3,4] and the impact of driving difficulty on CV community reintegration, participation and safety, we sought to test an OT-DI after an intermediate time frame, comparing driving performance and errors at baseline to post-test 2 conducted 3 months after intervention.
- This study is the first to examine the efficacy of an OT-DI at the intermediate time period.
- This study compared mean driving error differences among the following four conditions:
  1) control group at baseline and post-test 2,
  2) intervention group at baseline and post-test 2,
  3) control group versus intervention group at baseline, and
  4) control group versus intervention group at post-test 2.

METHOD

- We recruited post-deployment OIF/OEF CVs in the North Florida/South Georgia Veterans Health System with reported driving difficulties and diagnoses of mTBI, PTSD, and/or orthopedic injury who had not been medically advised not to drive (exclusion).
- Driving simulation took place in the VA's DriveSafety™ CDS-250 Mobile Simulator engineered into a 2010 Dodge Sprinter van.
- This experimental design involved randomization to intervention or control groups.
- 20 participants (10 per group) who completed all post-tests were included in this preliminary analysis.
- Testing included two simulation drives designed to elicit CV driving difficulty with elements such as roadside debris or pedestrians: 1) suburban, residential setting, and 2) a city/highway setting.

METHOD

- An occupational therapist/driver rehabilitation specialist (OT-DRS) assessed CV's simulated driving for the presence of eight error types shown in Figure 1.
- The intervention group received three approximately hour-long sessions focused on OT-DRS instruction in: remediation of driving errors noted at baseline (session 1), strategies to reduce errors (session 2), and driving the simulator with feedback (session 3).
- The control group received three hour-long traffic safety education sessions.
- Post-test 1 (after intervention) and post-test 2 (three months after post-test 1) used the same procedure as baseline testing.
- This study focused on baseline and post-test 2 results, using a one-tailed Wilcoxon Rank-Sum test to determine the between group and within group significant differences.

RESULTS

TABLE 1. Descriptive Statistics for Demographics

Variable	Control Group (n=10)	Intervention Group (n=10)	Group Differences (p < .05)
Age, M (SD)	36.00 (11.615)	38.60 (7.137)	W = 89.50, p = .26
Gender, n (%)			ns
Male	10 (100.00)	10 (100.00)	
Race, n (%)			Fisher's p = .21
Black or African American	2 (100.00)	0	
White	7 (70.00)	10 (100.00)	
Other	1 (10.00)	0	
Ethnicity, n (%)			Fisher's p = 1.00
Hispanic or Latino	2 (20.00)	1 (10.00)	
Not Hispanic	8 (80.00)	9 (90.00)	
Education , n (%)			Fisher's p = 1.00
Completed High School/GED	1 (10.00)	2 (20.00)	
Some College	6 (60.00)	3 (30.00)	
Associate's Degree or higher	3 (30.00)	5 (50.00)	
Marital Status, n (%)			Fisher's p = .35
Married	5 (50.00)	8 (80.00)	
Divorced	1 (10.00)	2 (20.00)	
Single	4 (40.00)	0	
Living Status, n (%)			Fisher's p = 1.00
Alone	1 (10.00)	2 (20.00)	
With Someone	9 (90.00)	8 (80.00)	

Note: W = Wilcoxon Rank Sum Test, Fisher's = Fishers exact test, ns = not significant

RESULTS

FIGURE 1. Comparison of Mean Driving Errors Between Groups

TABLE 2. Wilcoxon Rank-Sum Test for Within and Between Group Mean Driving Error Differences

Control Group at Baseline/Post-Test 2	Intervention Group at Baseline/Post-Test 2	Control Group vs. Intervention Group at Baseline	Control Group vs. Intervention Group at Post-Test 2
W = 75.00, p ≤ .112	W = 58.00, p ≤ .0001	W = 104.50, p ≤ .493	W = 75.00, p ≤ .011

FIGURE 2. VA Mobile DriveSafety CDS-250 Driving Simulator

DISCUSSION

- Demographic characteristics of the control and intervention groups were similar for key variables such as age and education.
- Two of the four Wilcoxon Rank-Sum analyses reached statistical significance: the intervention group's reduction of driving errors at baseline/post-test 2 and the between group differences of the control group and intervention group at post-test 2.
- The significant reduction in driving errors for the intervention group and significant between group difference at post-test 2 suggest efficacy of the OT-DI when compared to traffic safety education.
- This preliminary analysis lacks the sample size and statistical rigor to make definitive conclusions, however, initial results are promising.
- Establishing an effective OT-DI may lead to increased rehabilitation options for CVs and potentially improve driver fitness post-deployment.

REFERENCES

1. Plach, H. L., & Sells, C. H. (2013). Occupational performance needs of young veterans. American Journal of Occupational Therapy, 67, 73-81. doi: 10.5014/ajot.2013.003871
2. Zamorski, M. A., & Kelley, A. M. (2012). Psychological aspects of deployment and health behaviours (RTO Technical Report No. TF-HFM-164). Retrieved from North Atlantic Treaty Organisation, Research and Technology Organisation website: hhttp://natorto.cbw.pl/uploads/2012/5/$$TR-HFM-164-ALL.pdf
3. Classen, S., Levy, C., Meyer, D. L., Bewernitz, M., Lanford, D. N., & Mann, W. C. (2011). Simulated driving performance of combat veterans with mild traumatic brain injury and post traumatic stress disorder: A pilot study. American Journal of Occupational Therapy, 65(4), 419-427. doi: 10.5014/ajot.2011.000893
4. Classen, S., Cormack, N. L., Winter, S. M., Monahan, M., Yarney, A., & Platek, K. (2014). Efficacy of an occupational therapy driving intervention for returning combat veterans. OTJR: Occupation, Participation, and Health, 34(4), 176-182. doi: 10.3928/15394492-20141006-01

ACKNOWLEDGEMENTS

I-MAP
Institute For Mobility, Activity, and Participation

UF College of Public Health & Health Professions
UNIVERSITY of FLORIDA